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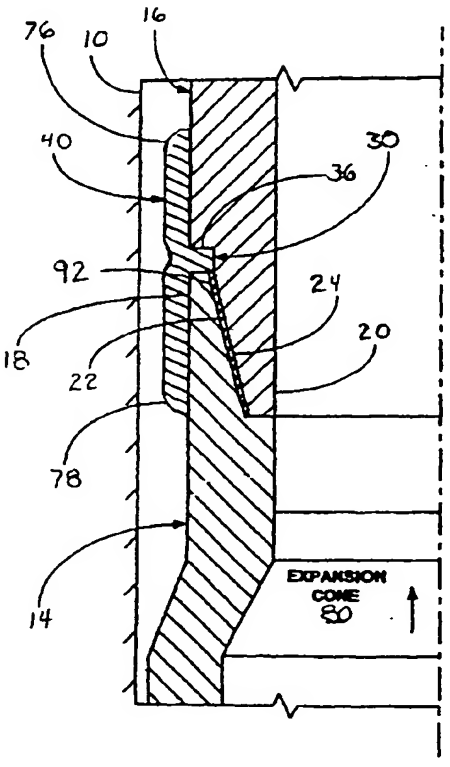
(54) Title: INTERPOSED JOINT SEALING LAYER METHOD OF FORMING A WELLBORE CASING



(57) Abstract: A method of forming a wellbore casing within a borehole (10) that traverses a subterranean formation, is provided by assembling a tubular liner by coupling a multi-layer tubular insert (92) threaded portion (24) of a first tubular member (16), and coupling a threaded portion (22) of a second tubular member (14) to the threaded portions (24) of the first (16) tubular member and the multi-layer tubular insert (92). the tubular liner assembly is positioned within the borehole (10); and the tubular liner assembly within the borehole (10) is radially expanded and plastically deformed. The multi-layer tubular insert (92) includes a first tubular insert having a first modulus of elasticity; and a second tubular insert coupled to the first tubular insert having a second modulus of elasticity. The first modulus of elasticity is different from the second modulus of elasticity.

ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US03/25676

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) : E21B 23/00; F16L 25/00
US CL : 166/207,380; 285/333
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 166/207,380,206,313,381,242.6; 285/33353; 403/179,273

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Please See Continuation Sheet

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A, P	US 2003/0067166 A1 (SILVEY, IV) 10 April 2003 (10.04.2003), whole document.	1-5
A	US 1,613,461 A (JOHNSON) 4 January 1927 (04.01.1927), whole document.	1-5
A	US 5,314,014 A (TUCKER) 24 May 1994 (24. 05.1994), whole document.	1-5
A	US 4,614,233 A (MENARD) 30 September 1986 (30.09.1986), whole document.	1-5

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
13 December 2003 (13.12.2003)

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INTERNATIONAL SEARCH REPORT

PCT/US03/25676

Continuation of B. FIELDS SEARCHED Item 3:
JPO, EPO, Derwent

Terms: sleeve, tubular expand/expansion, coupling/coupler

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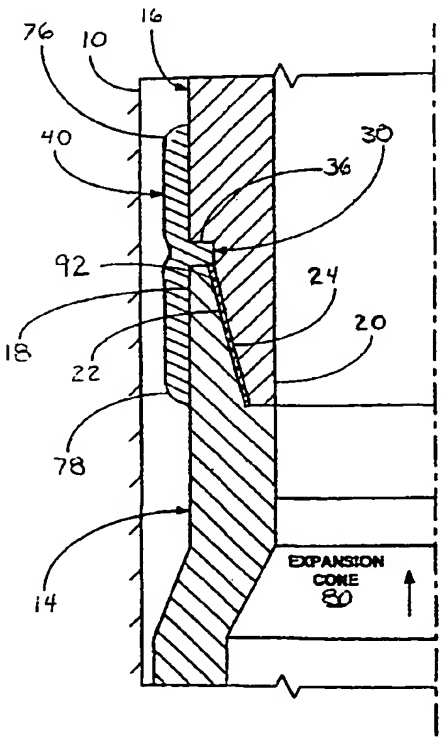

(57) Abstract: A method of forming a wellbore casing within a borehole (10) that traverses a subterranean formation, is provided by assembling a tubular liner by coupling a multi-layer tubular insert (92) threaded portion (24) of a first tubular member (16), and coupling a threaded portion (22) of a second tubular member (14) to the threaded portions (24) of the first (16) tubular member and the multi-layer tubular insert (92), the tubular liner assembly is positioned within the borehole (10); and the tubular liner assembly within the borehole (10) is radially expanded and plastically deformed. The multi-layer tubular insert (92) includes a first tubular insert having a first modulus of elasticity; and a second tubular insert coupled to the first tubular insert having a second modulus of elasticity. The first modulus of elasticity is different from the second modulus of elasticity.

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AMENDED CLAIMS

[0059] [received by the International Bureau on 10 June 2004 (10.06.04); original claims 1-5 replaced by new claims 1-72 (8 pages)]

Claims

What is claimed is:

1. A method of forming a wellbore casing within a borehole that traverses a subterranean formation, comprising:

assembling a tubular liner by a process comprising:

coupling a multi-layer tubular insert assembly to a threaded portion of a first tubular member; and

coupling a threaded portion of a second tubular member to the threaded portion of the first tubular member and the multi-layer tubular insert;

positioning the tubular liner assembly within the borehole; and

radially expanding and plastically deforming the tubular liner assembly within the borehole;

wherein the multilayer tubular insert comprises:

a first tubular insert having a first modulus of elasticity; and

a second tubular insert coupled to the first tubular insert having a second modulus of elasticity;

wherein the first modulus of elasticity is different from the second modulus of elasticity.

2. The method of claim 1, wherein the first and second tubular inserts comprise metallic materials.

3. The method of claim 2, wherein the first tubular insert comprises copper; and wherein the second tubular insert comprises cadmium.

4. The method of claim 1, wherein the modulus of elasticities of the first and second tubular inserts are less than the modulus of elasticities of the first and second tubular members.

5. A method of forming a wellbore casing within a borehole that traverses a subterranean formation, comprising:

assembling a tubular liner by a process comprising:

coupling a multilayer tubular insert assembly to a threaded portion of a first tubular member; and

coupling a threaded portion of a second tubular member to the threaded portion of the first tubular member and the multilayer tubular insert;

positioning the tubular liner assembly within the borehole; and

radially expanding and plastically deforming the tubular liner assembly within the borehole;

one of the layers of the multilayer tubular insert providing a fluidic seal after radially expanding and plastically deforming the tubular liner assembly; and

another one of the layers of the multilayer insert providing a micro fluidic seal after radially expanding and plastically deforming the tubular liner assembly.

6. The method of claim 1, wherein the modulus of elasticity for at least one of the tubular inserts is less than the modulus of elasticity of the first and second tubular members.

7. The method of claim 5, wherein the modulus of elasticity for at least one of the layers of the multilayer insert is less than the modulus of elasticity of the first and second tubular members.

8. The method of claim 1, wherein the melting point for at least one of the tubular inserts prior to the radial expansion and plastic deformation is less than the melting point after the radial expansion and plastic deformation.

9. The method of claim 5, wherein the melting point for at least one of the layers of the multilayer insert prior to the radial expansion and plastic deformation is less than the melting point after the radial expansion and plastic deformation.

10. The method of claim 1, wherein at least one of the tubular inserts releases energy during the radial expansion and plastic deformation.

11. The method of claim 5, wherein at least one of the layers of the multilayer insert releases energy during the radial expansion and plastic deformation.

12. The method of claim 1, wherein assembling the tubular liner further comprises:
coupling a tubular sleeve to the first and second tubular member.

13. The method of claim 12, wherein the sleeve receives the first and second tubular members.

14. The method of claim 12, wherein the sleeve is received within the first and second tubular members.

15. The method of claim 1, wherein assembling the tubular liner further comprises:
concentrating contact stresses between the first and second tubular member.

16. The method of claim 5, wherein assembling the tubular liner further comprises:
coupling a tubular sleeve to the first and second tubular member.

17. The method of claim 16, wherein the sleeve receives the first and second tubular members.

18. The method of claim 16, wherein the sleeve is received within the first and second tubular members.

19. The method of claim 5, wherein assembling the tubular liner further comprises:
concentrating contact stresses between the first and second tubular member.

20. A method of forming a wellbore casing within a borehole that traverses a subterranean formation, comprising:
assembling a tubular liner by a process comprising:
coupling a multi-layer tubular insert assembly to a threaded portion of a first tubular member; and
coupling a threaded portion of a second tubular member to the threaded portion of the first tubular member and the multi-layer tubular insert;
positioning the tubular liner assembly within the borehole; and
radially expanding and plastically deforming the tubular liner assembly within the borehole.

21. The method of claim 20, wherein assembling the tubular liner further comprises:
coupling a tubular sleeve to the first and second tubular member.

22. The method of claim 21, wherein the sleeve receives the first and second tubular members.

23. The method of claim 21, wherein the sleeve is received within the first and second tubular members.

24. The method of claim 20, wherein assembling the tubular liner further comprises:
concentrating contact stresses between the first and second tubular member.

25. The method of claim 20, wherein the modulus of elasticity for at least one of the layers of the multilayer insert is less than the modulus of elasticity of the first and second tubular members.

26. The method of claim 20, wherein the melting point for at least one of the layers of the

multilayer insert prior to the radial expansion and plastic deformation is less than the melting point after the radial expansion and plastic deformation.

27. The method of claim 20, wherein at least one of the layers of the multilayer insert releases energy during the radial expansion and plastic deformation.

28. A method of forming a wellbore casing within a borehole that traverses a subterranean formation, comprising:

assembling a tubular liner by a process comprising:

coupling a multi-layer tubular insert assembly to an end of a first tubular member; and

coupling an end of a second tubular member to the end of the first tubular member and the multi-layer tubular insert;

positioning the tubular liner assembly within the borehole; and

radially expanding and plastically deforming the tubular liner assembly within the borehole.

29. The method of claim 28, wherein assembling the tubular liner further comprises:

coupling a tubular sleeve to the first and second tubular member.

30. The method of claim 28, wherein assembling the tubular liner further comprises:

concentrating contact stresses between the first and second tubular member.

31. The method of claim 28, wherein the melting point for at least one of the layers of the multilayer insert prior to the radial expansion and plastic deformation is less than the melting point after the radial expansion and plastic deformation.

32. The method of claim 28, wherein at least one of the layers of the multilayer insert releases energy during the radial expansion and plastic deformation.

33. The method of claim 28, wherein the multilayer tubular insert comprises:

a first tubular insert having a first modulus of elasticity; and

a second tubular insert coupled to the first tubular insert having a second modulus of elasticity;

wherein the first modulus of elasticity is different from the second modulus of elasticity.

34. The method of claim 33, wherein the first and second tubular inserts comprise metallic materials.

35. The method of claim 34, wherein the first tubular insert comprises copper; and wherein the second tubular insert comprises cadmium.

36. The method of claim 33, wherein the modulus of elasticities of the first and second tubular inserts are less than the modulus of elasticities of the first and second tubular members.

37. A method of forming a wellbore casing within a borehole that traverses a subterranean formation, comprising:

assembling a tubular liner by a process comprising:

coupling an end of a first tubular member to an end of a second tubular member; and

coupling a tubular sleeve to the ends of the first and second tubular members;

positioning the tubular liner assembly within the borehole; and

radially expanding and plastically deforming the tubular liner assembly within the borehole;

wherein coupling the tubular sleeve to the ends of the first and second tubular members comprises applying magnetic energy to the tubular sleeve.

38. A tubular liner apparatus, comprising:

a first tubular member comprising a threaded portion;

a multi-layer tubular insert coupled to the threaded portion of the first tubular member; and

a second tubular member comprising a threaded portion coupled to the threaded portion of the first tubular member and the multi-layer tubular insert;

wherein the multilayer tubular insert comprises:

a first tubular insert having a first modulus of elasticity; and

a second tubular insert coupled to the first tubular insert having a second modulus of elasticity;

wherein the first modulus of elasticity is different from the second modulus of elasticity.

39. The apparatus of claim 38, wherein the first and second tubular inserts comprise metallic materials.

40. The apparatus of claim 39, wherein the first tubular insert comprises copper; and wherein the second tubular insert comprises cadmium.

41. The apparatus of claim 38, wherein the modulus of elasticities of the first and second tubular inserts are less than the modulus of elasticities of the first and second tubular members.

42. The apparatus of claim 38, wherein the melting point for at least one of the tubular inserts prior to a radial expansion and plastic deformation is less than the melting point after the radial expansion and plastic deformation.

43. The apparatus of claim 38, wherein at least one of the tubular inserts releases energy during a radial expansion and plastic deformation.

44. The apparatus of claim 38, wherein the apparatus further comprises:

a tubular sleeve coupled to the first and second tubular member.

45. The apparatus of claim 44, wherein the sleeve receives the first and second tubular members.

46. The apparatus of claim 44, wherein the sleeve is received within the first and second tubular members.

47. The apparatus of claim 38, wherein the apparatus further comprises:

means for concentrating contact stresses between the first and second tubular members.

48. A tubular liner apparatus, comprising:

a first tubular member comprising a threaded portion;

a multi-layer tubular insert coupled to the threaded portion of the first tubular member; and

a second tubular member comprising a threaded portion coupled to the threaded portion of the first tubular member and the multi-layer tubular insert;

wherein one of the layers of the multilayer tubular insert provide a fluidic seal; and

wherein another one of the layers of the multilayer insert provide a micro fluidic seal.

49. The apparatus of claim 48, wherein the modulus of elasticity for at least one of the layers of the multilayer insert is less than the modulus of elasticity of the first and second tubular members.

50. The apparatus of claim 48, wherein the melting point for at least one of the layers of the multilayer insert prior to a radial expansion and plastic deformation is less than the melting point after the radial expansion and plastic deformation.

51. The apparatus of claim 48, wherein at least one of the layers of the multilayer insert releases energy during a radial expansion and plastic deformation.

52. The apparatus of claim 48, further comprising:

a tubular sleeve coupled to the first and second tubular member.

53. The apparatus of claim 52, wherein the sleeve receives the first and second tubular members.

54. The apparatus of claim 52, wherein the sleeve is received within the first and second tubular members.

55. The apparatus of claim 48, further comprising:

means for concentrating contact stresses between the first and second tubular member.

56. A tubular liner apparatus, comprising:

a first tubular member comprising a threaded portion;

a multi-layer tubular insert coupled to the threaded portion of the first tubular member; and

a second tubular member comprising a threaded portion coupled to the threaded portion of the first tubular member and the multi-layer tubular insert.

57. The apparatus of claim 56, wherein the apparatus further comprises:

a tubular sleeve coupled to the first and second tubular member.

58. The apparatus of claim 57, wherein the sleeve receives the first and second tubular members.

59. The apparatus of claim 57, wherein the sleeve is received within the first and second tubular members.

60. The apparatus of claim 56, further comprising:

means for concentrating contact stresses between the first and second tubular member.

61. The apparatus of claim 56, wherein the modulus of elasticity for at least one of the layers of the multilayer insert is less than the modulus of elasticity of the first and second tubular members.

62. The apparatus of claim 56, wherein the melting point for at least one of the layers of the multilayer insert prior to a radial expansion and plastic deformation is less than the melting point after the radial expansion and plastic deformation.

63. The apparatus of claim 56, wherein at least one of the layers of the multilayer insert releases

energy during a radial expansion and plastic deformation.

64. A tubular liner apparatus, comprising:

a first tubular member;

a multi-layer tubular insert coupled to the first tubular member; and

a second tubular member coupled to the first tubular member and the multi-layer tubular insert.

65. The apparatus of claim 64, further comprising:

a tubular sleeve coupled to the first and second tubular member.

66. The apparatus of claim 64, further comprising:

means for concentrating contact stresses between the first and second tubular member.

67. The apparatus of claim 64, wherein the melting point for at least one of the layers of the multilayer insert prior to a radial expansion and plastic deformation is less than the melting point after the radial expansion and plastic deformation.

68. The apparatus of claim 64, wherein at least one of the layers of the multilayer insert releases energy during a radial expansion and plastic deformation.

69. The apparatus of claim 64, wherein the multilayer tubular insert comprises:

a first tubular insert having a first modulus of elasticity; and

a second tubular insert coupled to the first tubular insert having a second modulus of elasticity;

wherein the first modulus of elasticity is different from the second modulus of elasticity.

70. The apparatus of claim 69, wherein the first and second tubular inserts comprise metallic materials.

71. The apparatus of claim 70, wherein the first tubular insert comprises copper; and wherein the second tubular insert comprises cadmium.

72. The apparatus of claim 69, wherein the modulus of elasticities of the first and second tubular inserts are less than the modulus of elasticities of the first and second tubular members.